

**Special Project Plan: 2017 Large-Mesh Bottom Trawl
Survey of Crab and Groundfish for Kodiak, Chignik,
South Peninsula, and Eastern Aleutian Districts**

by

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and

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May 2017

Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



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Weights and measures (metric)		General		Mathematics, statistics	
centimeter	cm	Alaska Administrative Code	AAC	all standard mathematical signs, symbols and abbreviations	
deciliter	dL	all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.	alternate hypothesis	H _A
gram	g			base of natural logarithm	e
hectare	ha	all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.	catch per unit effort	CPUE
kilogram	kg			coefficient of variation	CV
kilometer	km			common test statistics	(F, t, χ^2 , etc.)
liter	L	at	@	confidence interval	CI
meter	m	compass directions:		correlation coefficient	
milliliter	mL	east	E	(multiple)	R
millimeter	mm	north	N	correlation coefficient	
		south	S	(simple)	r
		west	W	covariance	cov
Weights and measures (English)		copyright	©	degree (angular)	°
cubic feet per second	ft³/s	corporate suffixes:		degrees of freedom	df
foot	ft	Company	Co.	expected value	E
gallon	gal	Corporation	Corp.	greater than	>
inch	in	Incorporated	Inc.	greater than or equal to	≥
mile	mi	Limited	Ltd.	harvest per unit effort	HPUE
nautical mile	nmi	District of Columbia	D.C.	less than	<
ounce	oz	et alii (and others)	et al.	less than or equal to	≤
pound	lb	et cetera (and so forth)	etc.	logarithm (natural)	ln
quart	qt	exempli gratia		logarithm (base 10)	log
yard	yd	(for example)	e.g.	logarithm (specify base)	log ₂ , etc.
Time and temperature		Federal Information Code	FIC	minute (angular)	'
day	d	id est (that is)	i.e.	not significant	NS
degrees Celsius	°C	latitude or longitude	lat or long	null hypothesis	H ₀
degrees Fahrenheit	°F	monetary symbols		percent	%
degrees kelvin	K	(U.S.)	\$, ¢	probability	P
hour	h	months (tables and figures): first three letters	Jan.,...,Dec	probability of a type I error (rejection of the null hypothesis when true)	α
minute	min	registered trademark	®	probability of a type II error (acceptance of the null hypothesis when false)	β
second	s	trademark	™	second (angular)	"
Physics and chemistry		United States (adjective)	U.S.	standard deviation	SD
all atomic symbols		United States of America (noun)	USA	standard error	SE
alternating current	AC	U.S.C.	United States Code	variance	
ampere	A			population sample	Var
calorie	cal	U.S. state	use two-letter abbreviations (e.g., AK, WA)		var
direct current	DC				
hertz	Hz				
horsepower	hp				
hydrogen ion activity (negative log of)	pH				
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	V				
watts	W				

REGIONAL INFORMATION REPORT NO. 4K17-03

**SPECIAL PROJECT PLAN: 2017 LARGE-MESH BOTTOM TRAWL
SURVEY OF CRAB AND GROUND FISH FOR KODIAK, CHIGNIK,
SOUTH PENINSULA, AND EASTERN ALEUTIAN DISTRICTS**

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Division of Sport Fish, Research and Technical Services
333 Raspberry Road, Anchorage, Alaska, 99518-1565

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ABSTRACT

This report specifies special project objectives and methods of Alaska Department of Fish and Game's (ADF&G) 2017 Kodiak, Chignik, South Peninsula, and Eastern Aleutian districts large-mesh bottom trawl survey of crab and groundfish. This special project plan is used in conjunction with the large-mesh bottom trawl survey operational plan (Spalinger 2015b), which describes standard large-mesh trawl survey sampling. Special projects for 2017 include continuing a fishing power comparison between the R/V *Resolution* and the R/V *Solstice*, sampling shrimp and forage fish using small-mesh trawl gear in Pavlof and Chiniak bays, and monitoring sea stars for wasting disease throughout the survey.

Key words: Tanner crab, shellfish, groundfish, trawl survey, Kodiak, South Peninsula, Chignik, Eastern Aleutian, special projects

INTRODUCTION

From late May through early September 2017, the Alaska Department of Fish and Game (ADF&G) will conduct a bottom trawl survey in areas of known Tanner crab *Chionoecetes bairdi* habitat around Kodiak Island and south of the Alaska Peninsula from Cape Douglas to False Pass, as well as around the Eastern Aleutian Islands using a fixed-grid station design (Figure 1). Survey data is used to estimate relative abundance, sex composition, and maturity of Tanner crab and red king crab *Paralithodes camtschaticus*, as well as determine spatial distribution, species composition, density, and size frequency distribution of groundfish species. Standard sampling methods during the bottom trawl survey are described in the operational plan (Spalinger 2015b). This report details survey schedule, station boundaries, and sampling methods for special projects during the 2017 large-mesh bottom trawl survey.

OBJECTIVES

Objectives for special projects during the 2017 large-mesh bottom trawl survey are:

1. Conduct paired tows using the R/V *Resolution* and R/V *Solstice* to quantify species-specific differences in fishing power between the two vessels.
2. Conduct small-mesh tows in Pavlof and Chiniak bays, sampling shrimp and forage fish to continue the small-mesh time series in those areas.
3. Monitor sea stars for external signs of wasting disease throughout the survey.

METHODS

SURVEY AREA

The 27.7m ADF&G research vessel (R/V) *Resolution* will conduct survey hauls using a 400-mesh eastern otter trawl in the Kodiak, Chignik, South Peninsula, and Eastern Aleutian Tanner crab districts (Figure 1, Appendices A1-A14). This area includes waters of the Pacific Ocean south of the latitude of Cape Douglas (58°51.10' N lat.), west of 149°W long., and east of 172°W long., and Bering Sea waters south of 54°36.00' N lat. and east of 172°W long. The large-mesh bottom trawl survey stations represent approximately 13,150 km² in areas of known Tanner crab habitat.

FISHING POWER COMPARISON STUDY

The R/V *Resolution* and R/V *Solstice* (17.4 m) will continue a study that began in 2015. Vessels will perform paired tows in the Eastside section of the Kodiak Tanner crab district (Figures 2 and

3). Results are intended to estimate species specific fishing power correction factors between the vessels. Following the completion of the 2017 ADF&G bottom-trawl survey season, the R/V *Resolution* will undergo substantial structural and mechanical upgrades. This study will preserve the survey time series by providing a link between data collected by the R/V *Resolution* in its current configuration and the upgraded vessel. Details on this study, including data analysis methods can be found in Spalinger (2015a).

PAVLOF AND CHINIAK BAY SMALL-MESH TOWS

Since 1973, ADF&G and the National Marine Fisheries Service have jointly conducted small-mesh bottom trawl surveys in the Kodiak, Chignik, and South Peninsula districts using a high-opening box trawl with 3 bridles. This survey has been conducted annually in Pavlof Bay, Chiniak Bay, and other areas. In 2015, funding for this survey was greatly reduced. To maintain the Pavlof Bay small-mesh data time series, and provide a baseline to monitor shrimp populations, the R/V *Resolution* will perform a limited number of small-mesh tows during the large-mesh survey.

Towards the end of the South Peninsula large-mesh survey leg, boat officers will remove and store the large-mesh trawl net and replace it with small-mesh trawl survey gear (Jackson 2003). Up to 8 tows will be conducted in small-mesh survey stations in Pavlof Bay (Figure 4) and the catch will be sampled according to small-mesh bottom trawl survey methods (Jackson 2003). Upon completion of those tows, the large-mesh survey gear will be reinstalled and the large-mesh survey will continue.

After the completion of the large-mesh survey, the large-mesh trawl net will again be removed and replaced by small-mesh gear. Up to 8 tows will then be conducted in small-mesh survey stations in Chiniak Bay (Figure 5) during 2 separate day trips. Catch from those tows will be sampled according to small-mesh survey methods (Jackson 2003).

SEA STAR WASTING DISEASE MONITORING

Sea stars along the northeast coast of the Pacific Ocean are dying in large numbers from a wasting disease possibly caused by a densovirus (Hewson et al. 2014). External signs of the disease include skin lesions, tissue decay surrounding the lesions which leads to limb loss, body fragmentation, and death (Appendix B1). Monitoring groups have documented wasting disease symptoms in numerous species (Appendix B2) geographically ranging from Baja California, Mexico to Kachemak Bay, Alaska. Most observations of the disease have been from shorebased investigators in intertidal areas or subtidal areas accessible to divers.

During the 2017 trawl survey, sea stars in the subsample will be examined for symptoms of wasting disease including:

1. Lesions;
2. Deflated appearance;
3. Extreme twisting of rays;
4. Arm loss; and
5. Disintegration (Appendix B1).

If symptomatic animals are observed, information will be recorded on the sea star wasting disease log (Appendix B3) and a photo will be taken. Haul number, species name, number of

animals affected, and the file name of the photo will be recorded on the log. At the end of the survey the disease log and photos will be delivered to the lead trawl survey biologist. Observations will be reported to the Pacific Rocky Intertidal Monitoring group at <http://www.eeb.ucsc.edu/pacificrockyintertidal/data-products/sea-star-wasting/>. Photos will be sent to seastarwasting@googlegroups.com.

DATA FORM CUSTODY

The cruise leader will ensure all samples and data forms are completed and removed from the research vessel after each survey leg, including downloading electronically collected data to the vessel's dryhold computer and making backup copies of all electronic data by copying to an external hard drive, USB flash drive, or other location. For projects continuing on the next survey leg, data forms will be organized, labeled, and dried. Forms will be stored according to project and ordered sequentially by haul. Sampling logs will be completed and kept with data forms for reference. Data removed from the vessel will be taken directly to the lead trawl survey biologist.

SPECIAL PROJECT EQUIPMENT CHECKLIST

Fishing power comparison study (R/V Solstice)

- Nautical charts of the area to be surveyed
- Large-mesh trawl nets (2)
- MSI-9300 crane scale
- Marel M1100 platform scale
- Magnetic fish measuring board
- Fish sampling computer
- Teguar waterproof computer with speakers and on-deck crab data entry
- Electronic calipers (3)
- Caliper cables (6)
- Laptop for data entry
- On-deck sampling forms
- Skipper trawl record forms
- Fish baskets
- Measuring tapes
- Navigational software for vessel
- Electronic file of survey stations for vessel navigational program
- Electronic file of trawl tracks from most recent surveys for navigational program

Pavlof/Chiniak small-mesh tows

- Small-mesh trawl nets (2)
- Marel M60 platform scale
- 1-gallon Ziploc bags
- 1-quart Ziploc bags
- Small-mesh on-deck forms

Sea star wasting disease monitoring

- Sea star wasting disease log
- Digital camera

PERSONNEL AND SURVEY SCHEDULE

R/V Resolution crew - Captain Denis Cox Jr., Kurt Pedersen, Gary Wilson

	<i>Paired tows May 31-June 5</i>	<i>Chiniak Bay June 8 and 9</i>	<i>Marmot Bay June 12-June 16</i>	<i>Eastside Kodiak, and Alitak June 20-July 6</i>
<i>Cruise Leader:</i>	Kally Spalinger	Kally Spalinger	Kally Spalinger	Kally Spalinger
<i>Biological Crew:</i>	Collin Hakkinen Natura Richardson Kim Phillips Kayla Bevaart	Collin Hakkinen Sherry Barker Joy Brooks Michael Knutson	Collin Hakkinen Sherry Barker Joy Brooks Natura Richardson	Collin Hakkinen Sherry Barker Joy Brooks Michael Knutson
	<i>Unalaska, Peninsula, and Chignik July 11-August 15</i>	<i>Westside Kodiak and Shelikof Strait August 20-29</i>	<i>Chiniak Bay (small-mesh) Aug 31 and Sept 1</i>	
<i>Cruise Leader:</i>	Nathaniel Nichols (First half) Natura Richardson (Second half)	Michael Knutson	Kally Spalinger	
<i>Biological Crew:</i>	Collin Hakkinen Sherry Barker Joy Brooks	Collin Hakkinen Sherry Barker Joy Brooks	Collin Hakkinen Sherry Barker Joy Brooks	

R/V Solstice crew - Captain David Anderson, James Weise, Phyllis Shirron

	<i>Paired tows May 31-June 5</i>
<i>Cruise Leader:</i>	Nathaniel Nichols
<i>Biological Crew:</i>	Sherry Barker Joy Brooks Michael Knutson

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- Spalinger, K. 2015b. Operational plan: Large-mesh bottom trawl survey of crab and groundfish: Kodiak, Chignik, South Peninsula, and Eastern Aleutian management districts—standard protocol 2015–2019. Alaska Department of Fish and Game, Regional Operational Plan ROP.CF.4K.2015.20, Kodiak.

FIGURES

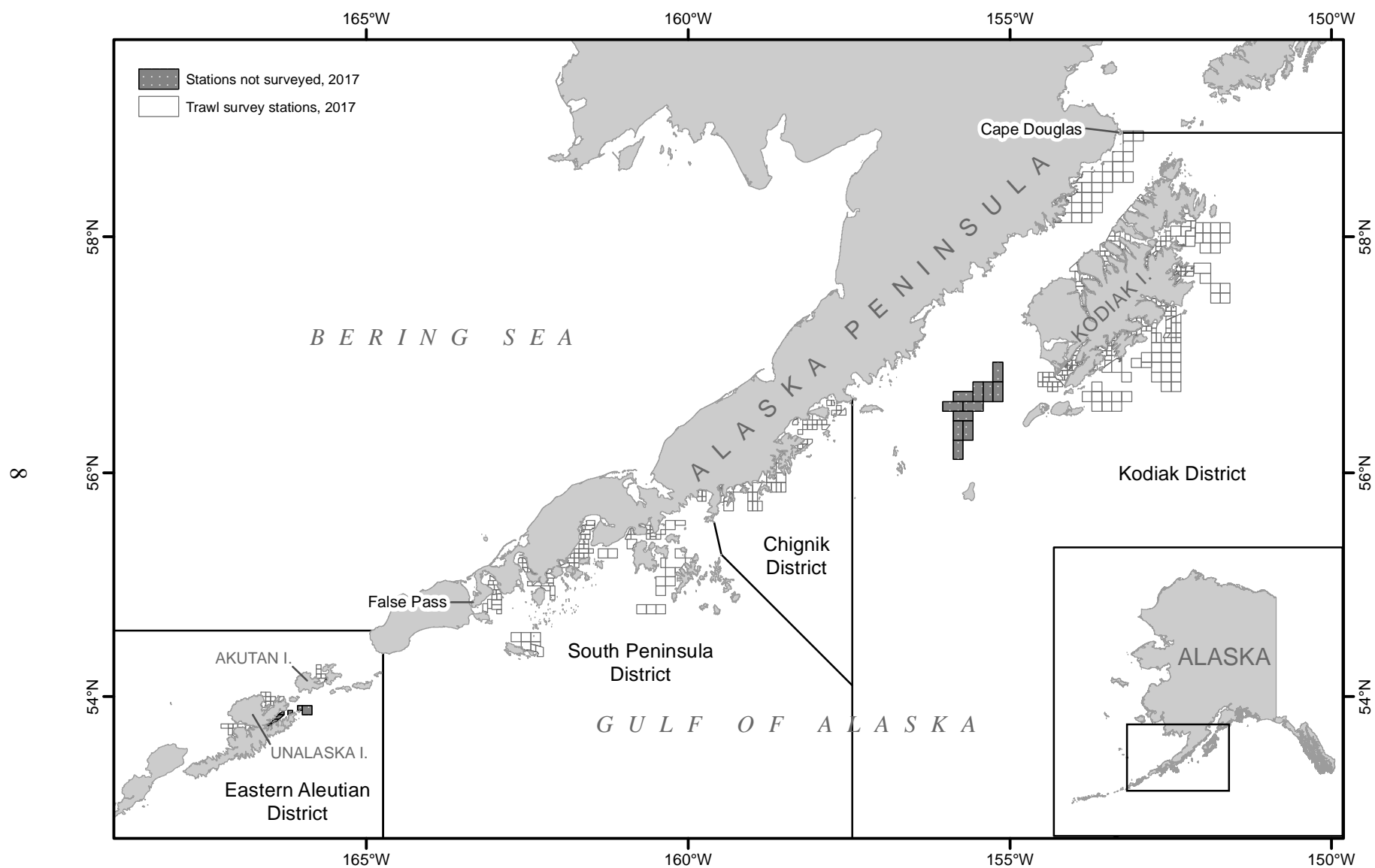


Figure 1.—Kodiak, Chignik, South Peninsula, and Eastern Aleutian districts large-mesh bottom trawl survey stations, 2017.

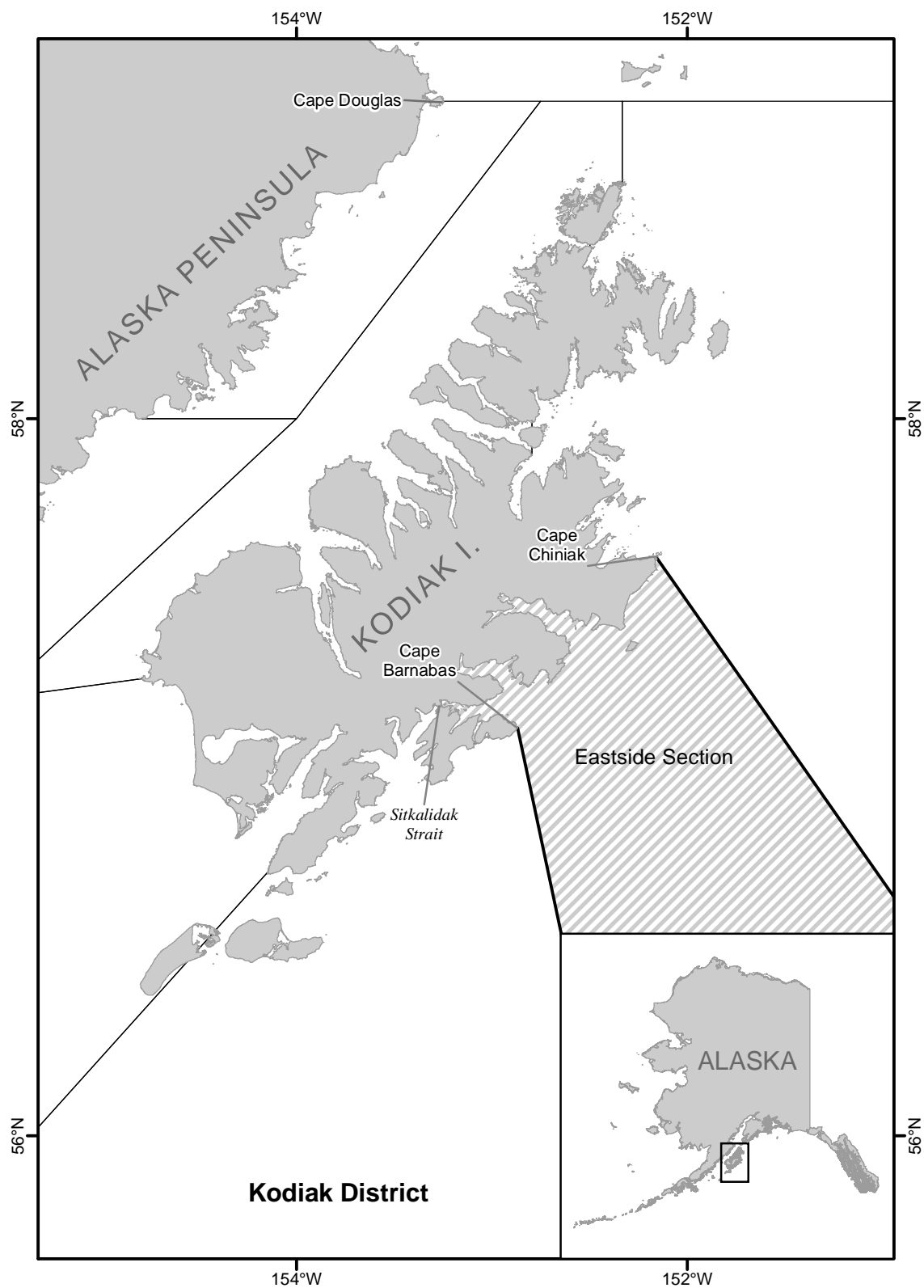


Figure 2.—Map of the Kodiak Tanner crab management district highlighting the Eastside section.

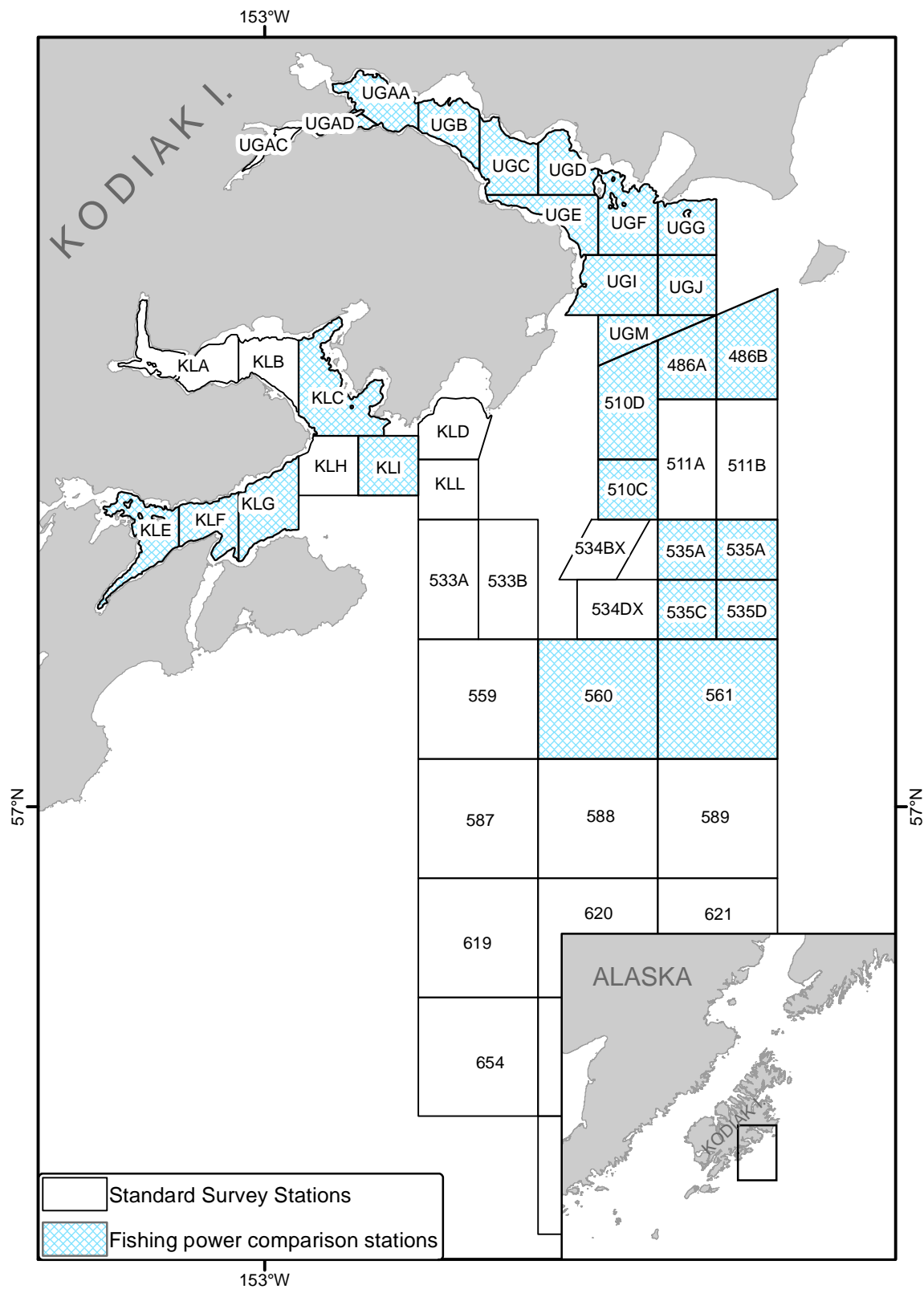


Figure 3.—Stations to be targeted during the 2017 fishing power comparison survey between the R/V Resolution and the R/V Solstice in the Eastside section of the Kodiak Tanner crab district.

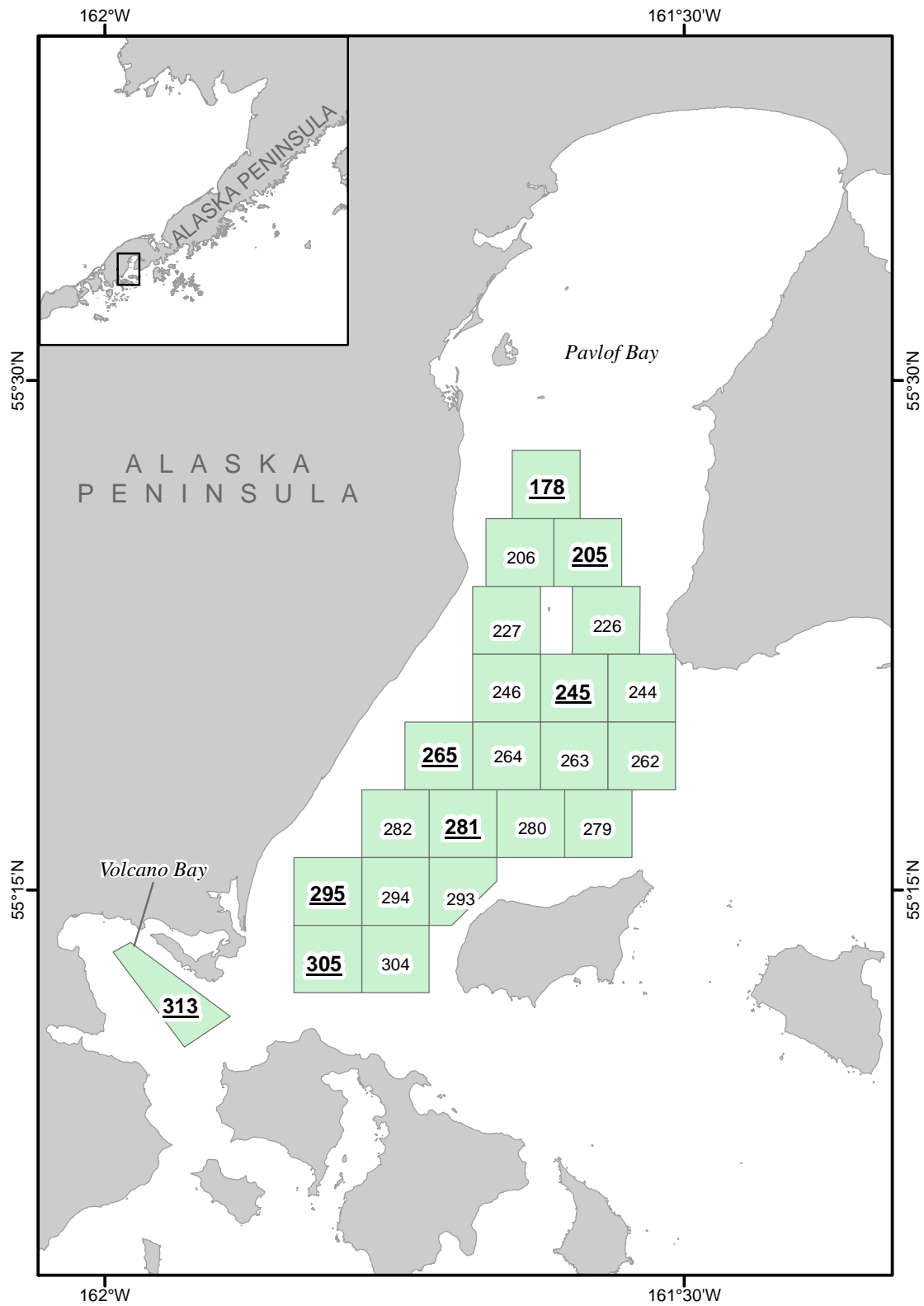


Figure 4.—Small-mesh trawl survey stations in Pavlof Bay. Stations in **bold** and underlined text will be towed in 2017.

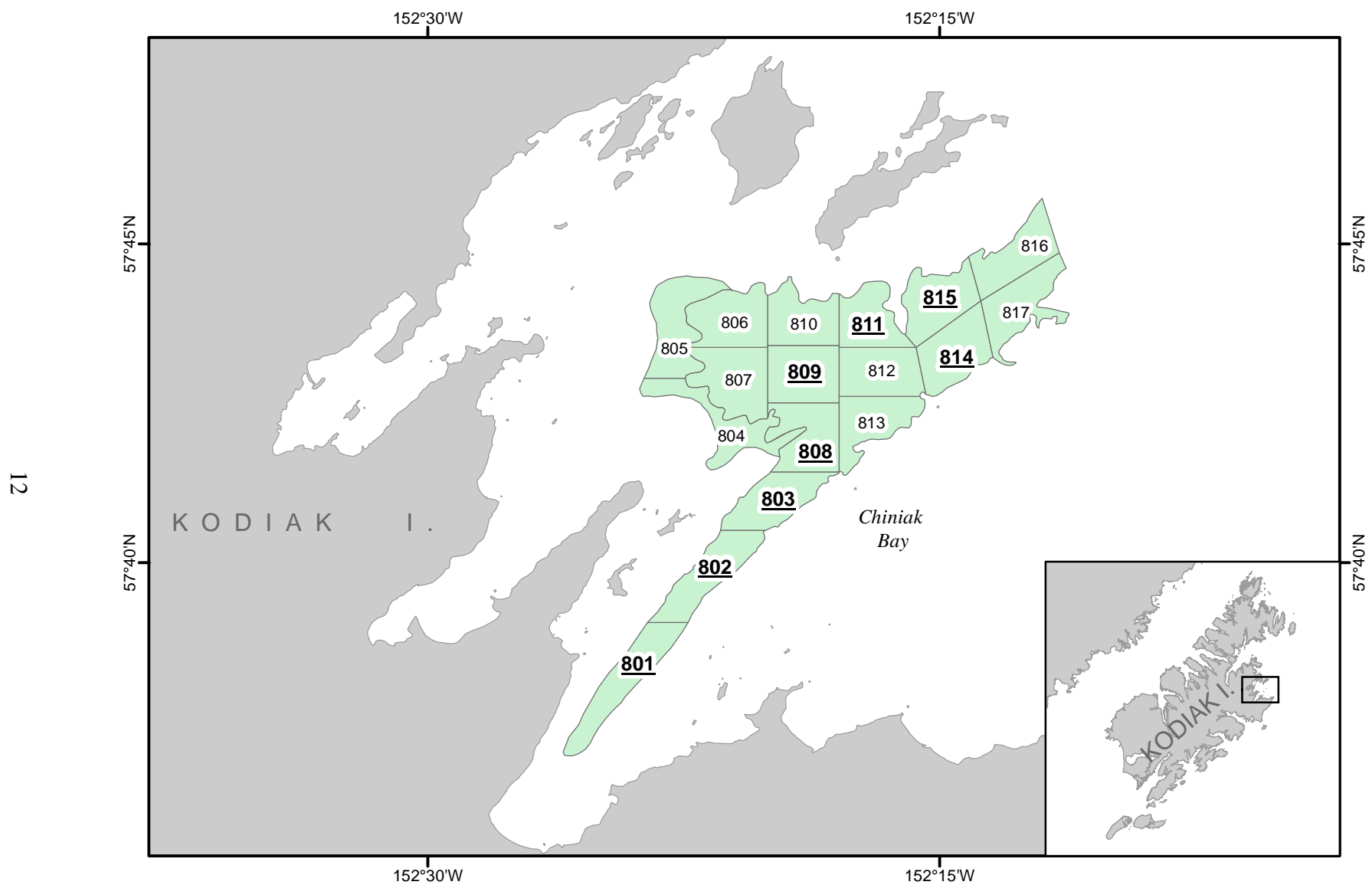
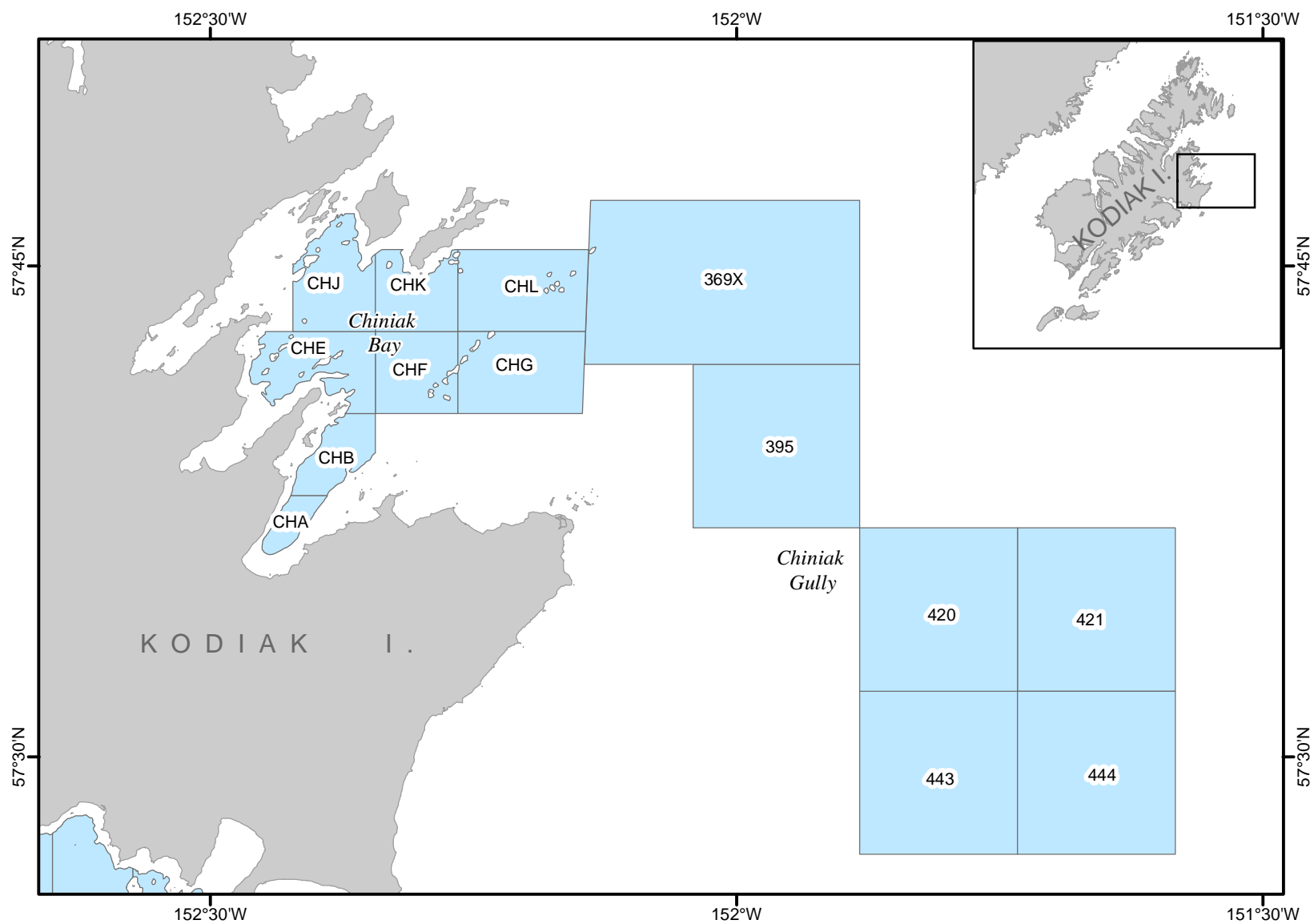


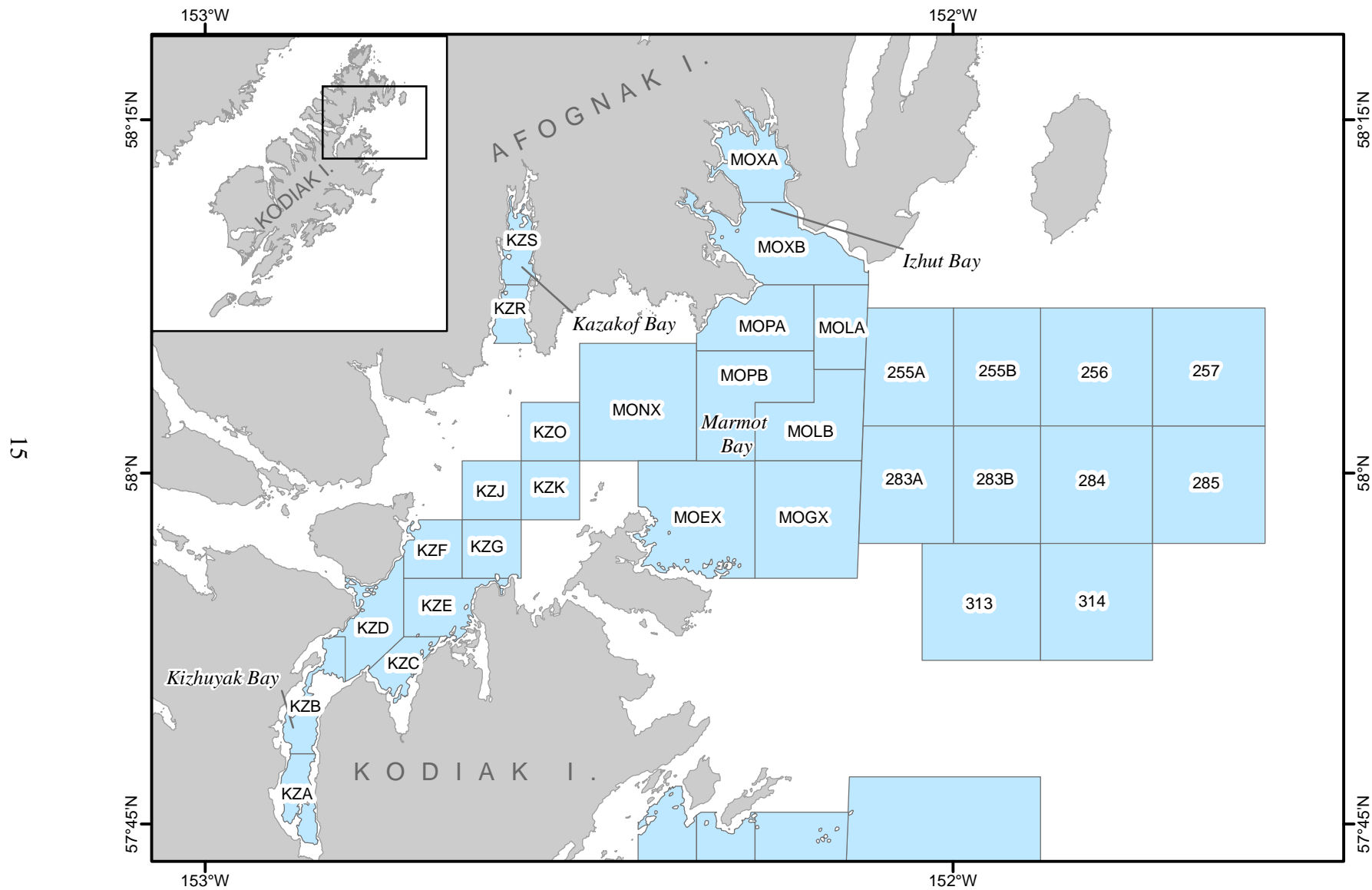
Figure 5.—Small-mesh trawl survey stations in Chiniak Bay. Stations in **bold** and underlined text will be towed in 2017.

APPENDIX A. TRAWL SURVEY STATION MAPS

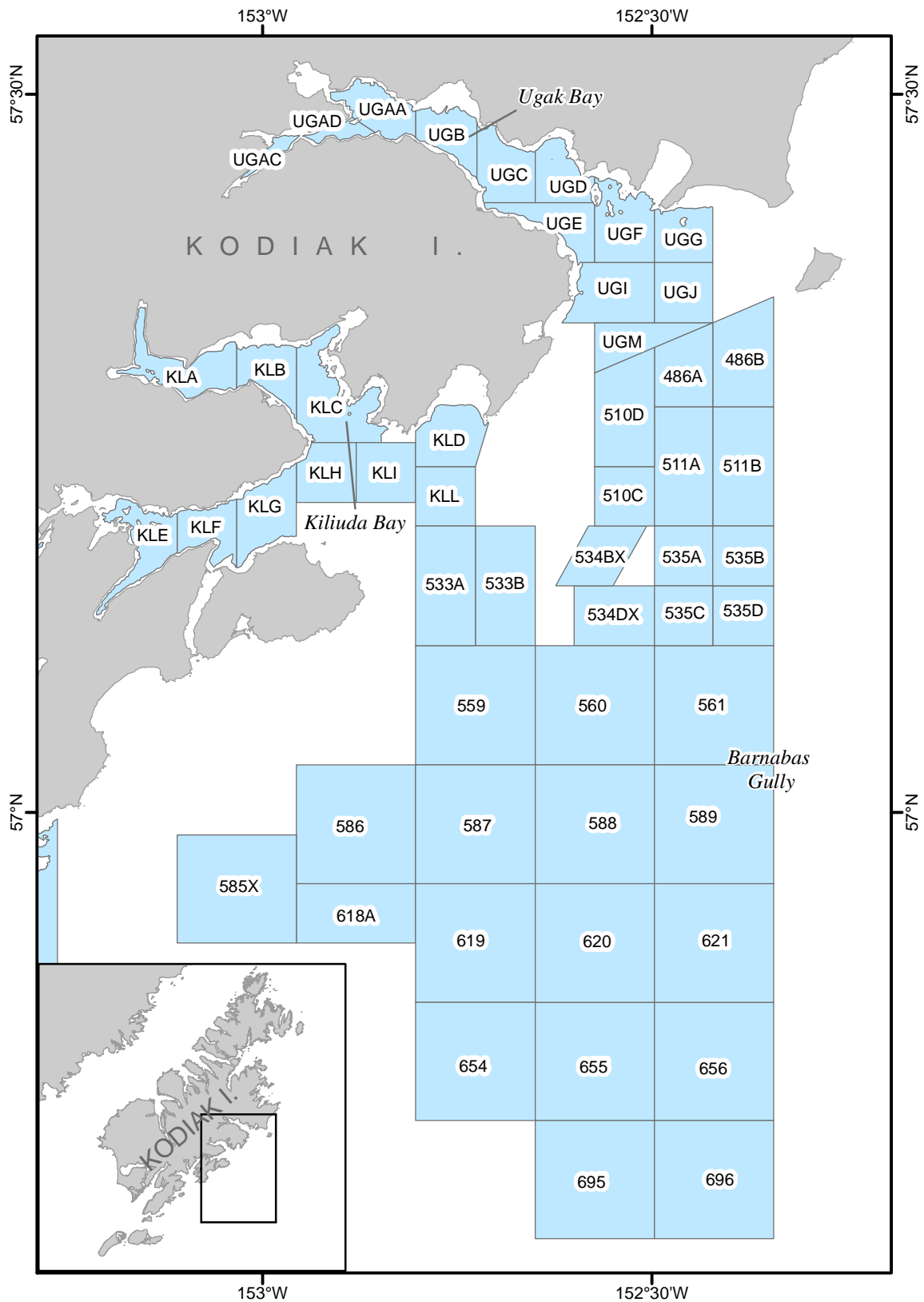
Appendix A1.—Station boundaries and names, Chiniak Bay and Chiniak Gully, 2017 Kodiak District trawl survey.



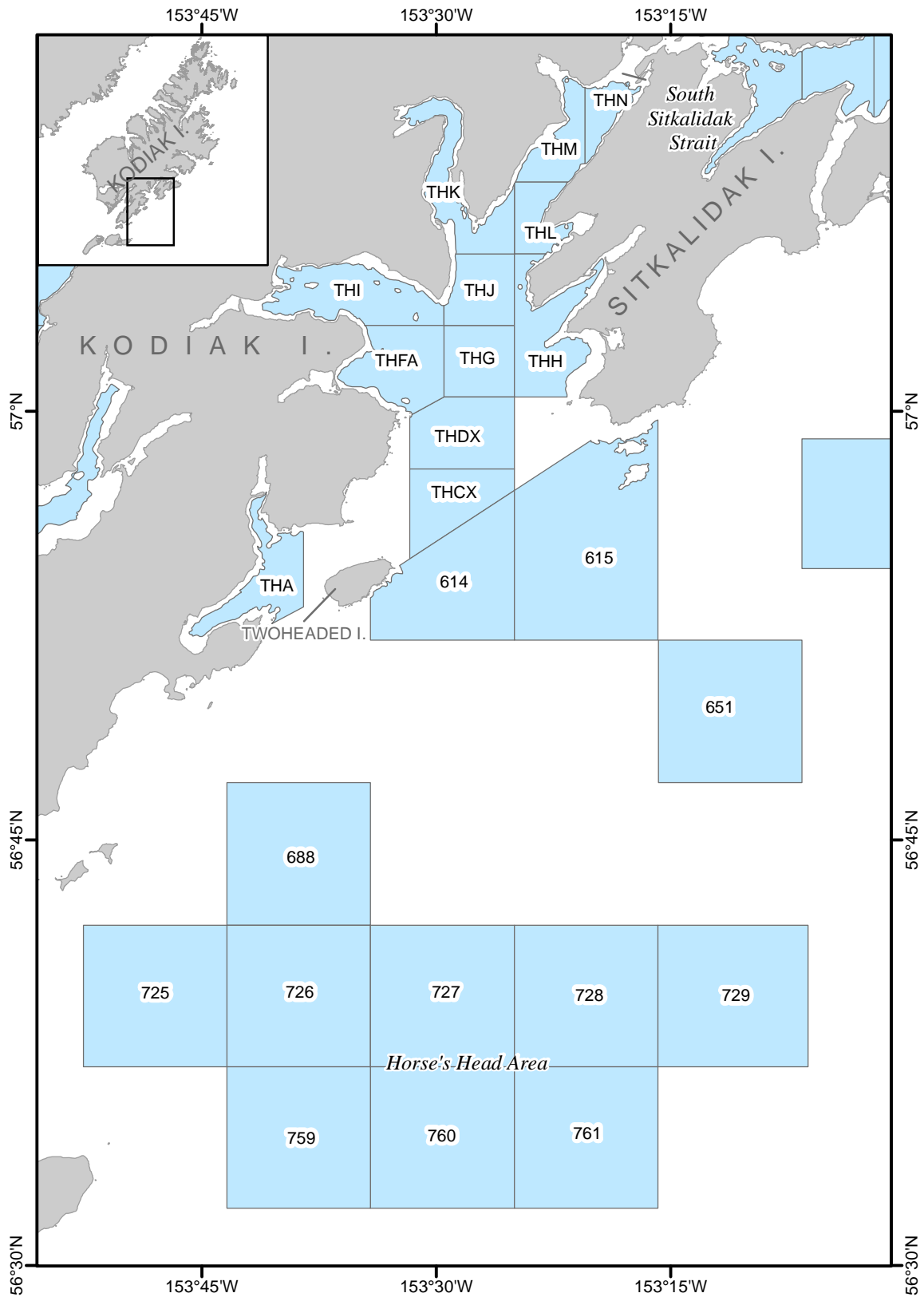
Appendix A2.—Station boundaries and names, Izhut, Kazakof, Kizhuyak, and Marmot bays, 2017 Kodiak District trawl survey.



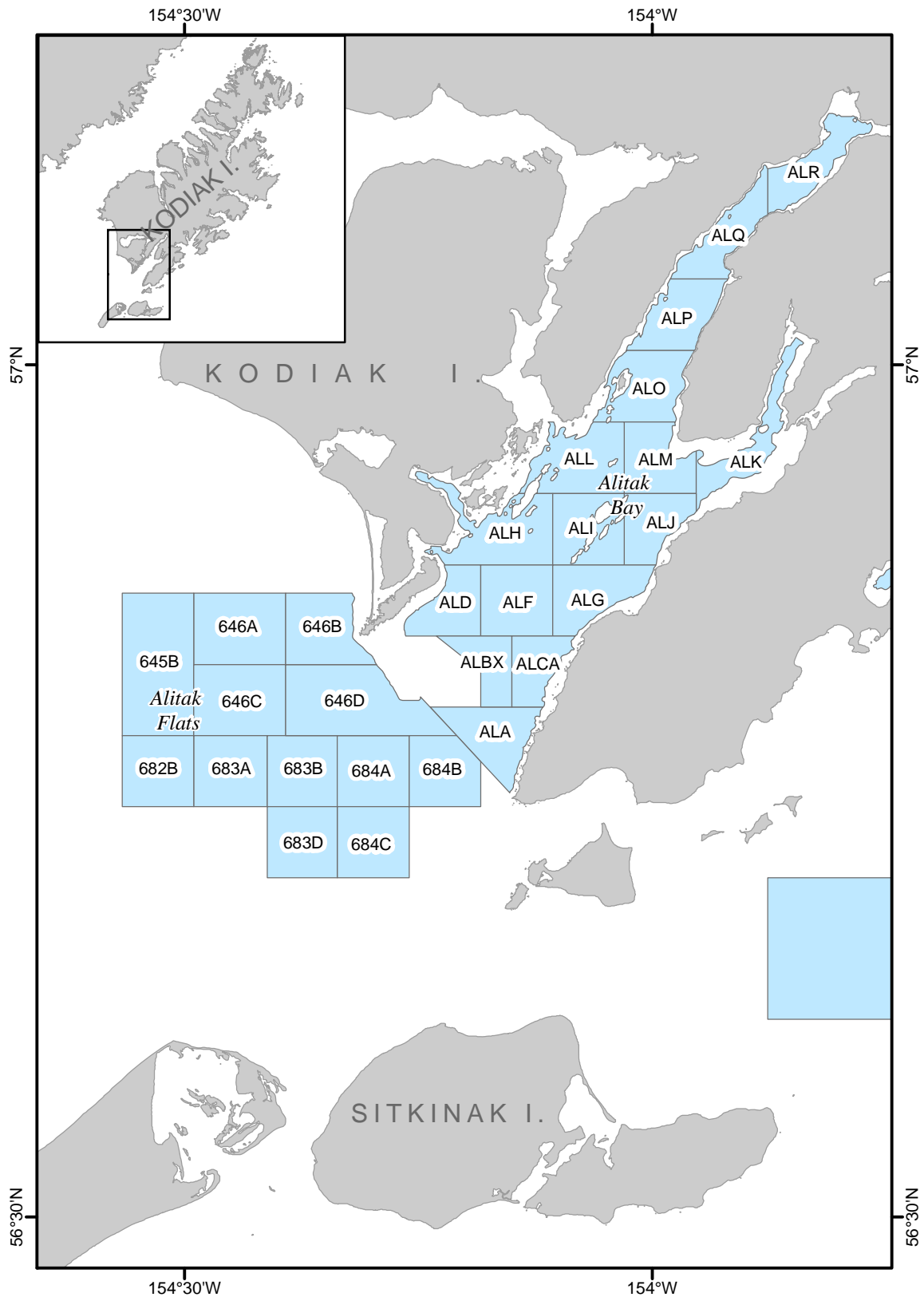
Appendix A3.—Station boundaries and names, Ugak Bay, Kiliuda Bay, and Barnabas Gully, 2017 Kodiak District trawl survey.



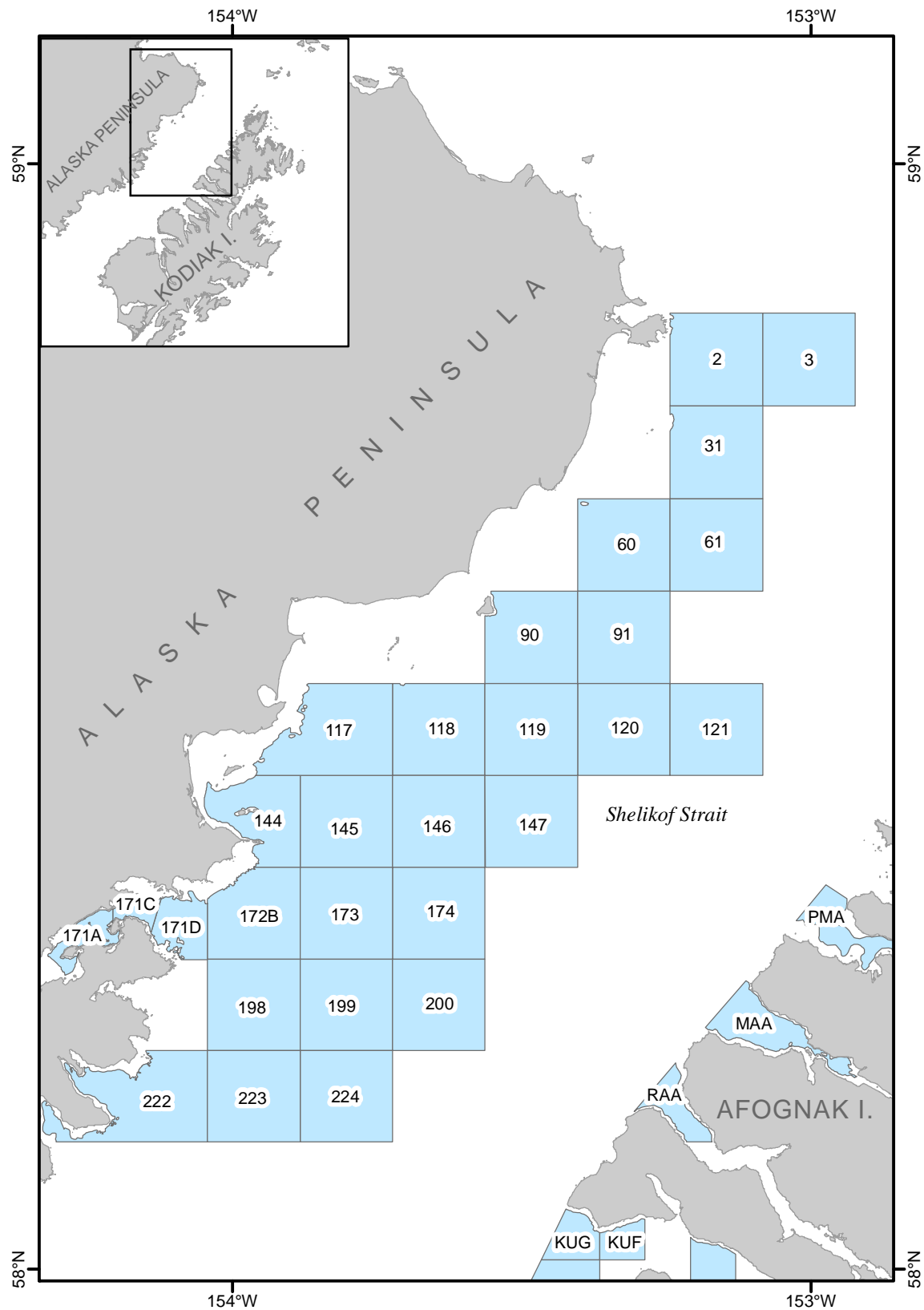
Appendix A4.—Station boundaries and names, South Sitkalidak Strait, Twoheaded Island, and Horse's Head area, 2017 Kodiak District trawl survey.



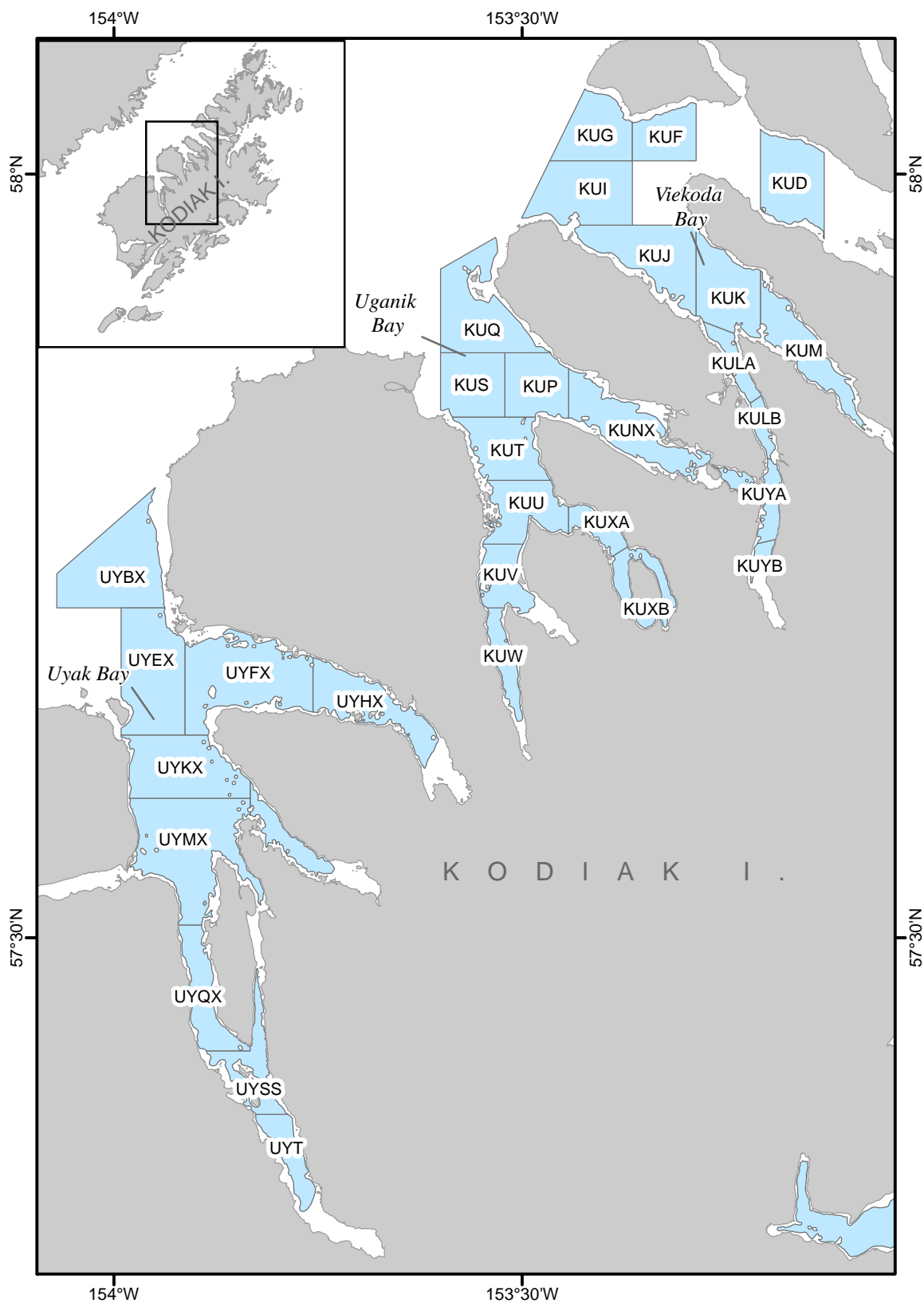
Appendix A5.—Station boundaries and names, Alitak Bay and Alitak Flats, 2017 Kodiak District trawl survey.



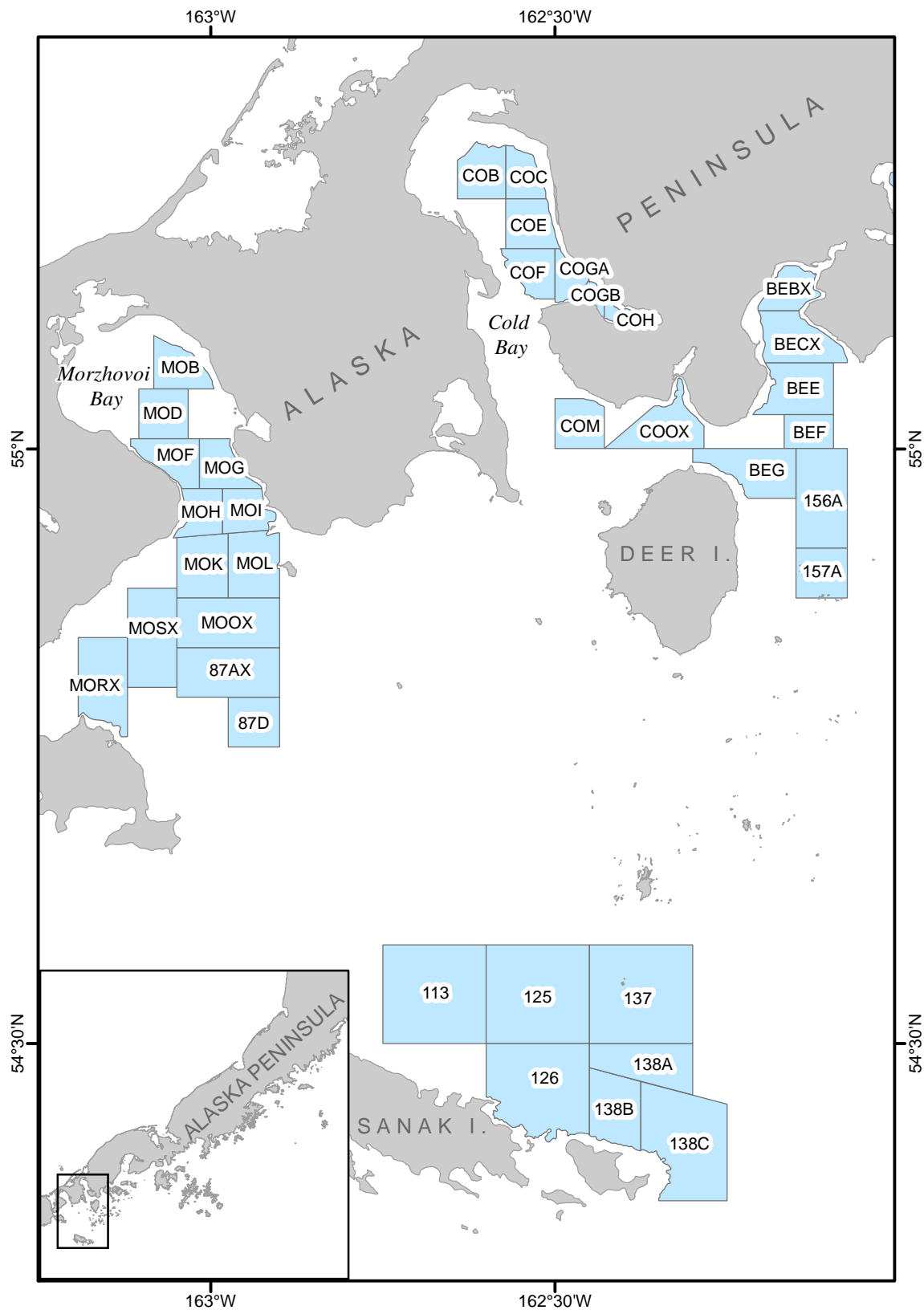
Appendix A6.—Station boundaries and names, Shelikof Strait and Afognak Island, 2017 Kodiak District trawl survey.



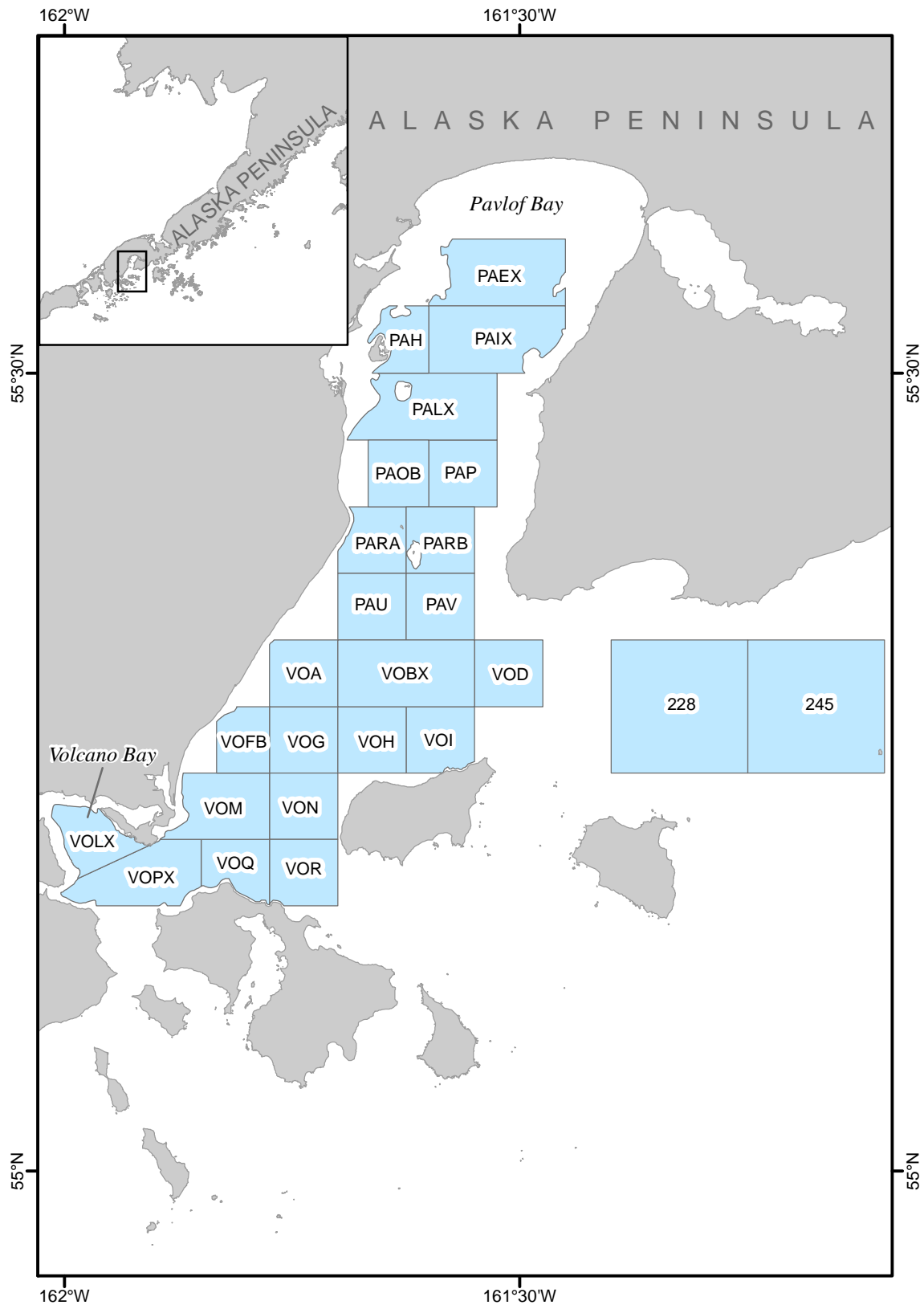
Appendix A7.—Station boundaries and names, Uyak, Uganik, and Viekoda bays, 2017 Kodiak District trawl survey.



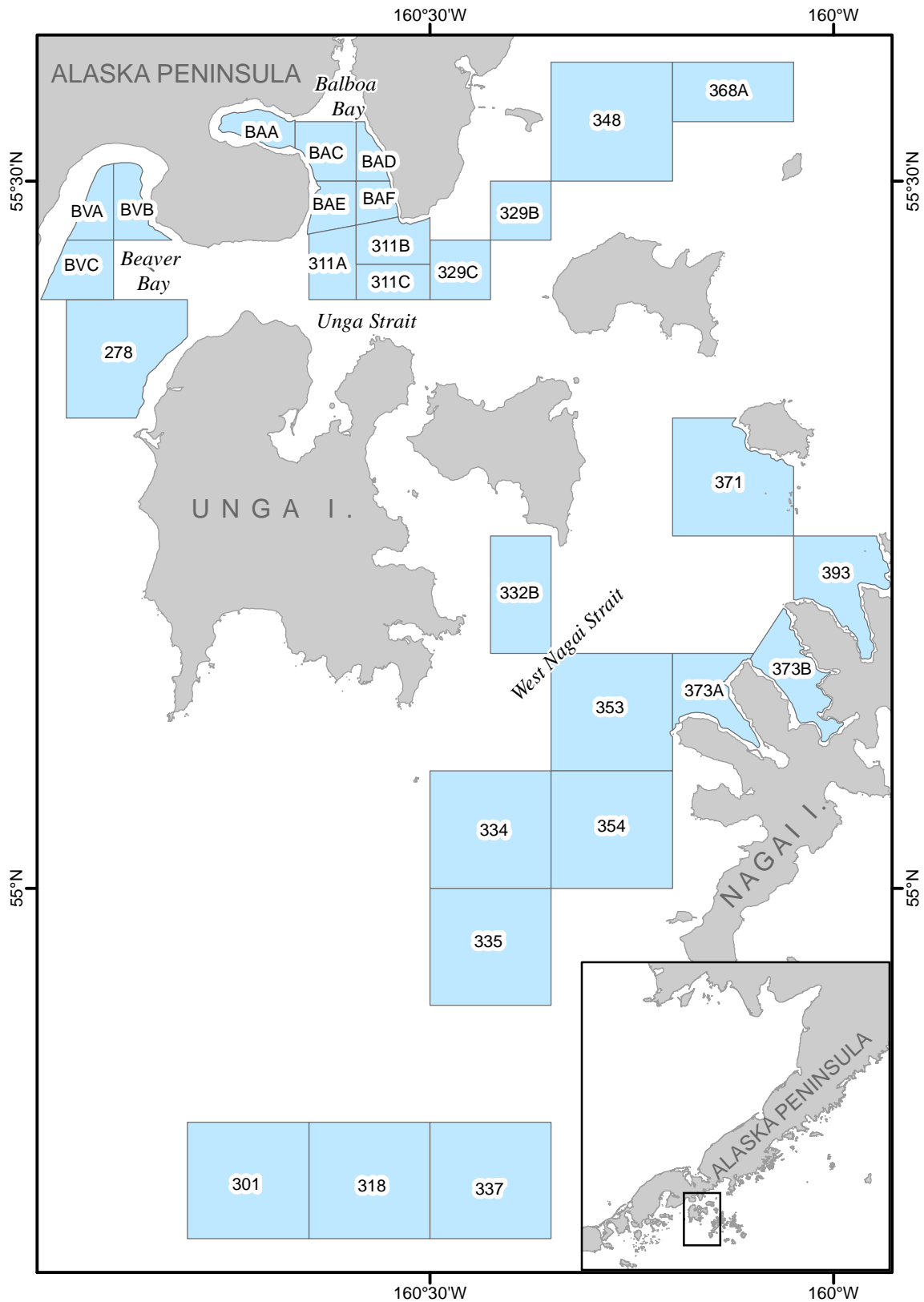
Appendix A8.—Station boundaries and names, Morzhovoi Bay, Cold Bay, Deer Island, and Sanak Island, 2017 South Peninsula District trawl survey.



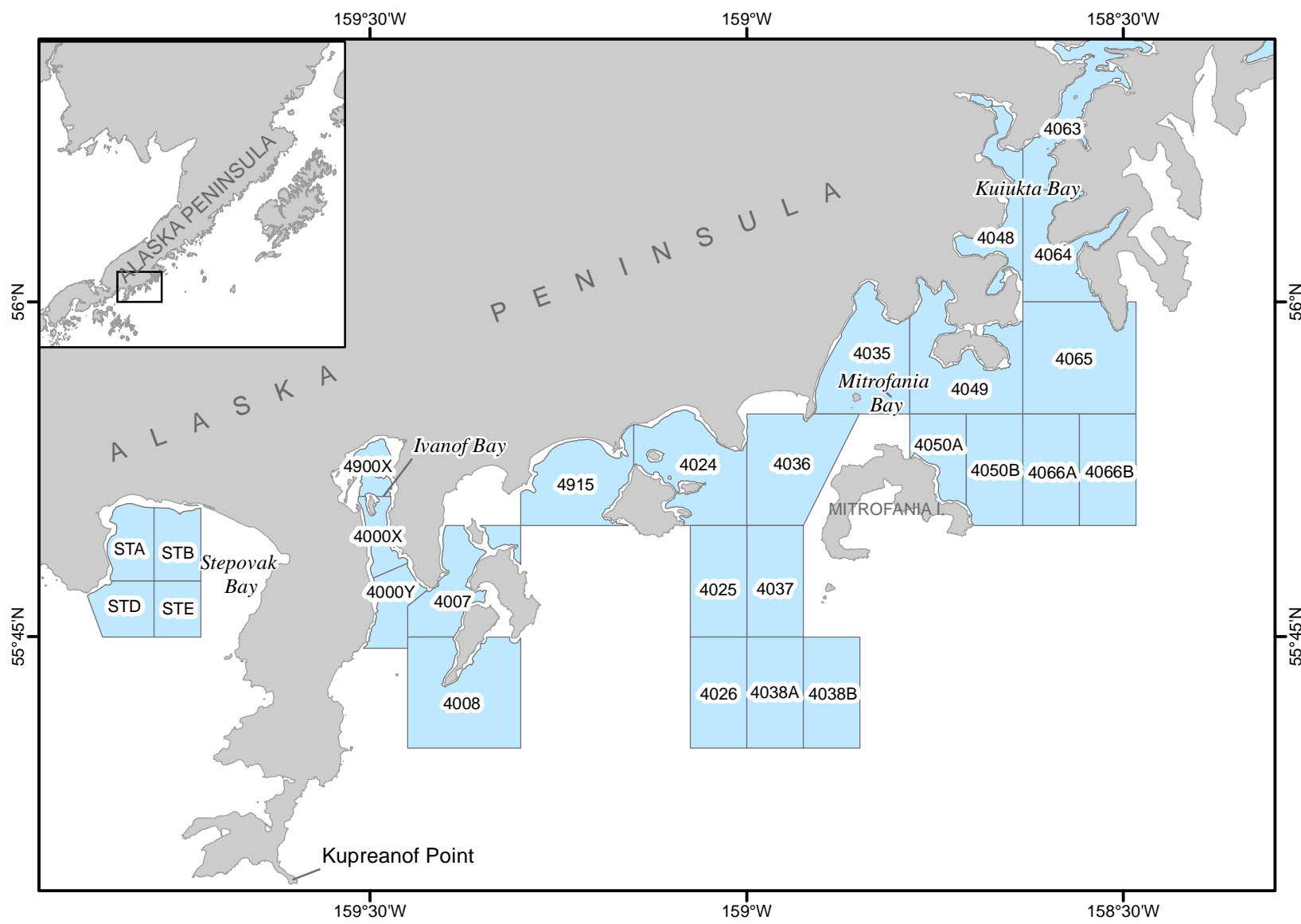
Appendix A9.—Station boundaries and names, Pavlof and Volcano bays, 2017 South Peninsula District trawl survey.



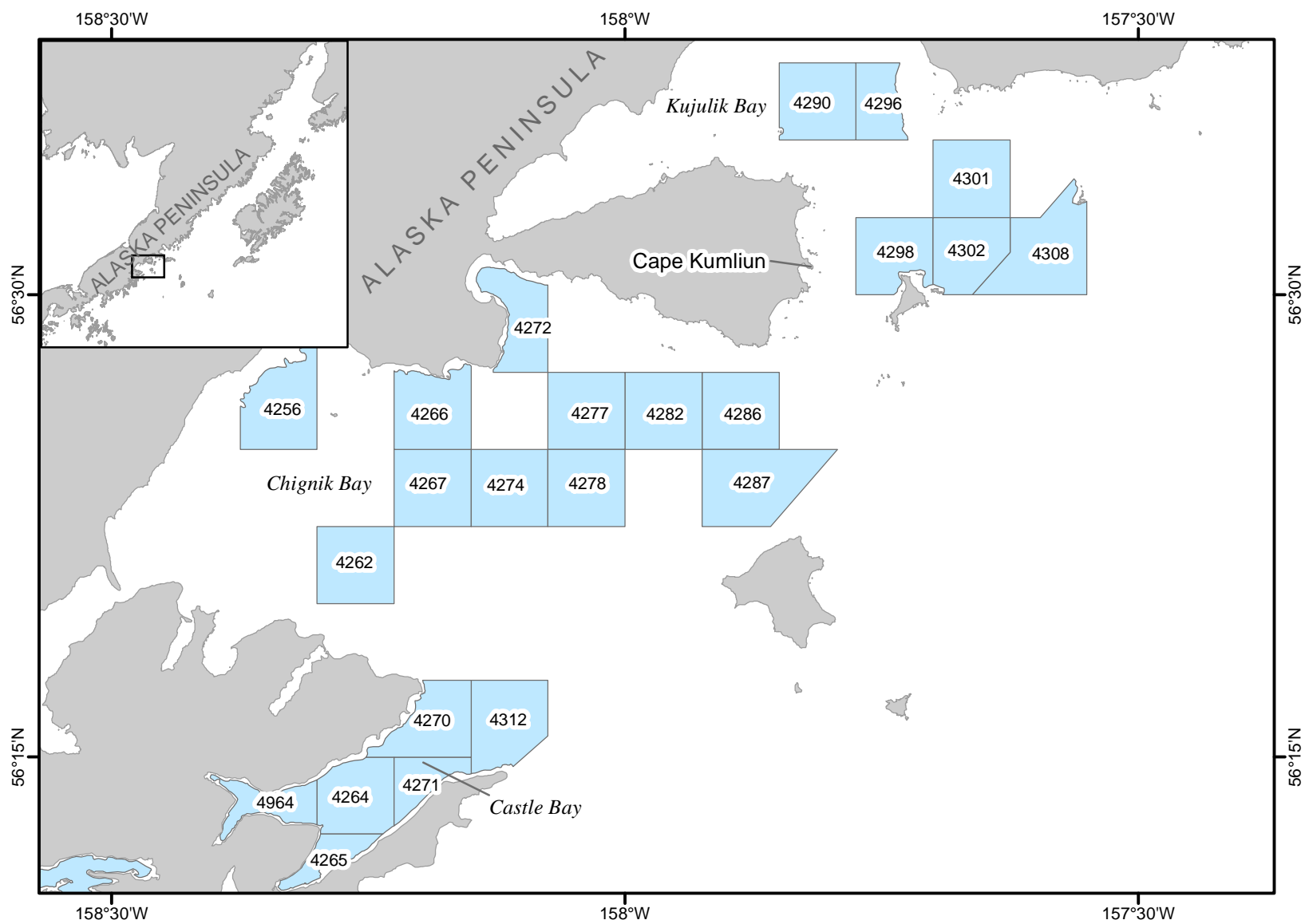
Appendix A10.—Station boundaries and names, Unga Strait, Beaver Bay, Balboa Bay, and West Nagai Strait, 2017 South Peninsula District trawl survey.



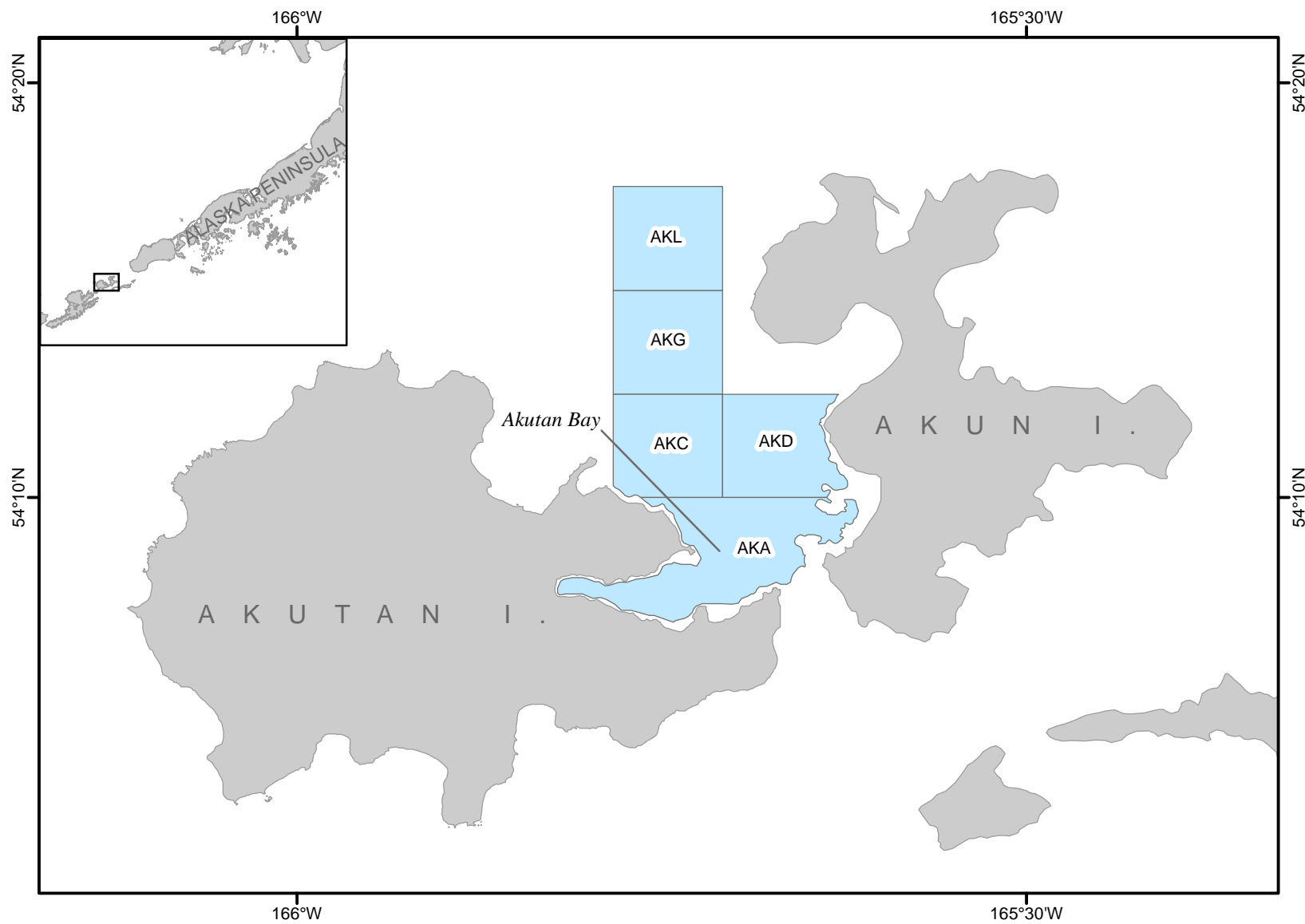
Appendix A11.—Station boundaries and names, Stepovak, Ivanof, Mitrofanía, and Kuiukta bays, 2017 South Peninsula and Chignik District trawl surveys.



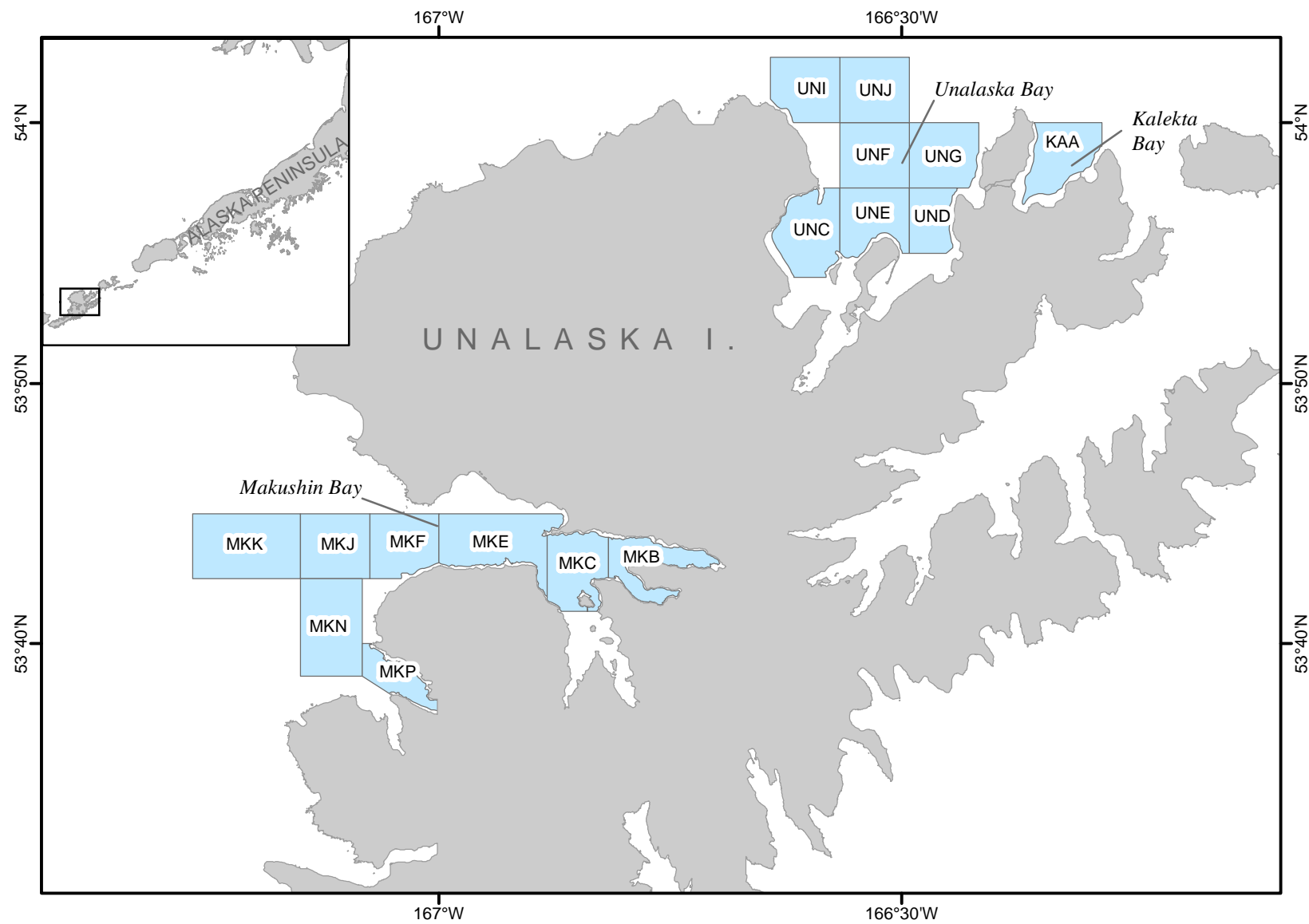
Appendix A12.—Station boundaries and names, Kujulik, Chignik, and Castle bays, 2017 Chignik District trawl survey.



Appendix A13.—Station boundaries and names, Akutan Bay, 2017 Eastern Aleutian District trawl survey.



Appendix A14.—Station boundaries and names, Unalaska, Kalekta, and Makushin bay, 2017 Eastern Aleutian District trawl survey.



APPENDIX B. SEA STAR WASTING DISEASE MONITORING

Appendix B1.–Examples of “mild” and “severe” wasting/injury likely due to sea star wasting disease.

Examples of Mild and Severe Disease
Last updated 2014-12-11

pacificrockyintertidal.org
seastarwasting.org

Examples of “mild” and “severe” wasting/injury likely due to sea star wasting syndrome

Note: The following photos are intended to be used as a guide for identifying signs of wasting across many species of sea stars. Sea stars respond to many types of stress in a similar manner, so the tissue degradation and injuries shown in these photos may not be due to sea star wasting syndrome. However, all photos are from areas where SSWS was prevalent and thus likely responsible for the conditions shown.

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Examples of Mild and Severe Disease
Last updated 2014-12-11

pacificrockyintertidal.org
seastarwasting.org

Pisaster ochraceus

Mild Photo: Kayla Balmer



Severe Photo: John Ugerotz



Photos:
Melissa
Miner



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-continued-

Evasterias troschelii

Mild

Photo:
Mark Nayer



Photos:
Jan Kocian



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Examples of Mild and Severe Disease
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Severe

Photos: Jeff Harris



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Pycnopodia helianthoides

Mild



Photos: Mark Nayer

Note emaciated
appearance



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Severe



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-continued-

Examples of Mild and Severe Disease
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Pisaster giganteus

Mild



Severe



Photos: Leanne Foster

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Examples of Mild and Severe Disease
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Pisaster brevispinus

Mild



Photos:
Mark Nayer

Severe



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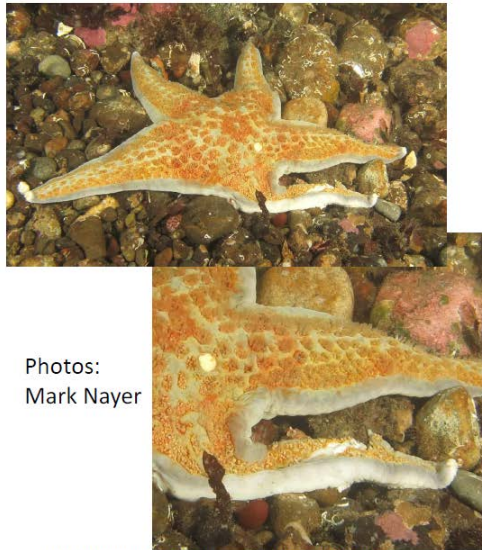
Photos:
Ken Bondy

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Dermasterias imbricata

Mild



Photos:
Mark Nayer

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Severe

Photo:
Ethan Flanagan



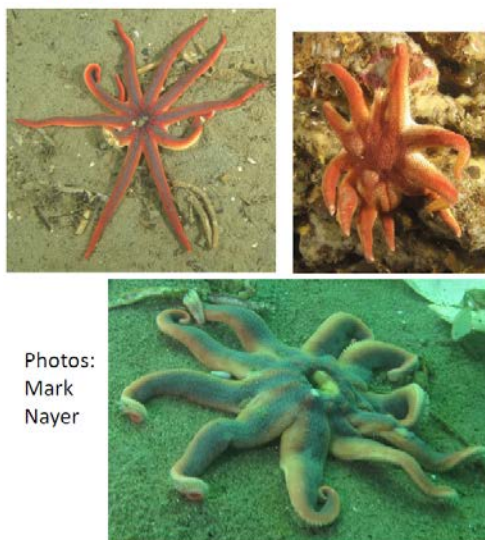
Photo:
Nate Fletcher



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Solaster spp.

Mild



Photos:
Mark
Nayer

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Severe

Photo: Mark Nayer



Photo: Neil McDaniel

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Orthasterias koehleri

Mild



Photos: Feiro Marine Life Center



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Examples of Mild and Severe Disease
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Severe

No photo available

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Leptasterias spp

Mild



Photo: Steve Fradkin

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Severe



Photos:
Melissa
Miner



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-continued-

Patiria (Asterina) miniata

Mild

- No photo available

Severe



Photo: Ryan Berger

Pteraster spp.

Mild



Photo: Mark Nayer

Severe



Photo: Jackie Hildering

Examples of Mild and Severe Disease
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Crossaster papposus

mild



severe



Photos: Neil McDaniel

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Examples of Mild and Severe Disease
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seastarwasting.org

Henricia spp.

Mild

Photo: Linda Larsen



Note tissue degradation on single (uppermost) arm. Lighter patches on central disk are normal coloration pattern for this species of *Henricia*

Severe

Photo: Wendy Steffensen



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Sea Star Species Affected by Wasting Syndrome:

High Mortality

Solaster dawsoni (morning sun star)
Evasterias troschelii (mottled star)
Pisaster brevispinus (giant pink star)
Pisaster ochraceus (ochre/purple star)
Pycnopodia helianthoides (sunflower star)

Some Mortality

Patiria (Asterina) miniata (bat star)
Dermasterias imbricata (leather star)
Solaster stimpsoni (striped sun star)
Orthasterias koehleri (rainbow star)
Pisaster giganteus (giant star)
Henricia spp. (blood star)
Leptasterias spp (six-armed star)

Likely affected, mortality level not well documented

Astropecten spp. (sand star)
Mediaster aequalis (vermillion star)
Linkia columbiae (fragile star)
Lophaster furcilliger vexator (crested star)
Crossaster papposus (rose star)
Astrometis sertulifera (fragile rainbow star)
Stylasterias forreri (velcro star)

Appendix B3.—Sea Star Wasting Disease log.

[illegible]